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Note by the Astronomer Royal on a Determination of the Mass of Mars.

Professor Asaph Hall, in his admirable paper on the satellites of *Mars*, after announcing his first inference in regard to the value of the mass of *Mars*, $\frac{1}{3107713}$, has cited the values $\frac{1}{1846082}$, $\frac{1}{2546320}$, $\frac{1}{2680337}$, $\frac{1}{3200900}$, $\frac{1}{2994790}$, $\frac{1}{2812526}$, successively adopted by Laplace, Delambre, Burckhardt, Hansen and Olufsen, and Le Verrier (Le Verrier has used the two last stated). I have not been able to trace the investigations on which these numbers are founded.

But I may perhaps call attention to an investigation made by myself, fifty-one years ago, published in the *Philosophical Transactions* for the year 1828. It is one of the results of a discussion of 10½ years' Greenwich observations of the Sun, from 1816, July 30, to 1826, December 30. The number of observations (from which all observations made under unfavourable circumstances have been eliminated) is 1,212. The result for the mass of *Mars* is $\frac{1}{3734602}$.

The Memoir in the *Philosophical Transactions*, 1828, to which I have alluded above, has not, apparently, met the eye of our transatlantic friends. As illustrating the progress of science in defining the place of the Sun and the masses of planets and Moon, it may perhaps be worthy of a short abstract at the present time.

In the year 1827 the attention of the Board of Longitude was called (in the first instance by Mr., afterwards Sir James, South) to the state of the Solar Tables used in the *Nautical Almanac*; and I, as a member of that Board, undertook the task of comparing the tables with observations; and a mass of more than 1,200 transits of the Sun, with stars, was placed in my hands by the then Astronomer Royal, Mr. Pond. For the method of discussing these I refer to the *Philosophical Transactions*, 1828. The principal results were the following:—

The mass of *Mars* adopted by Delambre was reduced in the proportion of 9 : 5 nearly. (It is to be remarked that the perturbations produced by *Mars* are small.)

The mass of *Venus* was somewhat reduced, and the value thus obtained agrees sensibly with that now adopted.

The mass of the Moon was reduced from $\frac{1}{60}$ nearly to $\frac{1}{80}$ nearly, a value now universally adopted. I do not remember whether any preceding investigation had led to a similar result.

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Corrections were found for the excentricity of the Earth's orbit and for the place of perihelion.

A correction was found for the epoch of Sun's longitude; and this correction led to a result of some importance. The comparison of this with similar corrections found by Burckhardt for other epochs convinced me that there was an unrecognised inequality in the Sun's longitude, and finally led to the discovery of the equation of long period in the motions of the Earth and *Venus*.

To these results applying to the movable bodies of the solar system, I may add one which affects the honour of the Royal Observatory as maintained by my predecessor, Mr. Pond, that the whole train of the investigations testifies strongly to the excellence of the transit observations made sixty years ago, which appear to have been as good as those of the present day.

1878, *November* 16.

On the Conjunction of Mars and Saturn, 1879, *June* 30.

By Sir G. B. Airy, Astronomer Royal.

On 1879, June 30, will occur a conjunction of *Mars* and *Saturn* of unusual interest. Adopting the elements of the *Nautical Almanac*, Mr. Dunkin, at my request, has computed the geocentric places of the centres of the two planets for every hour—and through the greater part of the time for every quarter-hour—from June 30, 2^h to 20^h. The results for every quarter-hour, from 6^h to 9^h Greenwich Mean Solar Time, are laid down in a chart, which I have the pleasure of submitting to the Society. The small movements of *Saturn* are there applied, in opposite directions, to the true movements of *Mars*; so that, with a fixed representation of *Saturn*, the relative position of *Mars* is correctly given for each of those times. The magnitudes of the two planets and the position of *Saturn's* ring are accurately represented, the lower line of the chart being parallel to the Equator.

It will be seen that the nearest approach of the two planets occurs at 7^h 30^m nearly, and that the distance between their centres is then $1' \, 12''$. These numbers will be affected by the possible errors of the planetary tables.

In the table which accompanies the chart Mr. Dunkin has given the local times at Vienna, the Cape of Good Hope, Madras, Sydney, San Francisco, and Cordoba (Argentine Confederation), corresponding to the Greenwich hours above mentioned. (These stations are selected as giving a chain of longitudes proceeding easterly round the Earth, with some range of latitude.) The local times of planet-rise and sunrise are also given, as limiting the times of observation. It is mortifying to us to remark that the planets cannot be seen at their closest proximity in Europe

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